



MIT Sloan School of Management

Working Paper 4457-04
January 2004

Sunk Costs and Antitrust Barriers to Entry

Richard Schmalensee

© 2004 by Richard Schmalensee. All rights reserved. Short sections of text, not to exceed two paragraphs, may be quoted without explicit permission, provided that full credit including © notice is given to the source.

This paper also can be downloaded without charge from the
Social Science Research Network Electronic Paper Collection:
<http://ssrn.com/abstract=486944>

Sunk Costs and Antitrust Barriers to Entry

*By Richard Schmalensee**

What definition of “barriers to entry” should be used in U.S. antitrust decision-making?

In addressing this question here, I take as given the objectives of U.S. antitrust policy and the role that the analysis of entry conditions plays in U.S. antitrust decision-making. Section I argues that U.S. antitrust is concerned with consumers’ surplus, not overall economic welfare, and Sections II and III illustrate that this choice of objective has important implications for the proper definition and assessment of “antitrust barriers to entry,” i.e., conditions that constrain the ability of new entrants into a market to contribute to the achievement of antitrust policy goals. As with the definition of “market,” other definitions of “entry barriers” may be more useful in contexts other than antitrust, as Preston McAfee et al discuss at length.

Two definitions dominate discussions of entry in the antitrust literature. For Joe S. Bain (1968, p. 252) the conditions of entry are “the extent to which, in the long run, established firms can elevate their selling prices above the minimal average costs of production and distribution ... without inducing potential entrants to enter the industry.” (See also Joe S. Bain (1956, p. 3).) If established firms are efficient, and if rent-sharing and rent-seeking are unimportant, this implies the persistence of excess economic profit. Jean Tirole (ch. 8) is among the textbook authors adopting the Bain definition.

George Stigler (p. 67) defines a barrier to entry as “...a cost of producing ... which must be borne by a firm which seeks to enter an industry but which is not borne by firms already in the industry.” In any particular case, the Bain and Stigler definitions pose very different empirical questions. In particular, Stigler’s definition is generally taken to imply that economies of scale cannot give rise to entry barriers if cost functions are identical, whereas Bain argued the

contrary. (It is important to distinguish between Bain’s definition of entry barriers and his analysis of their determinants. His definition may be useful even though much of his analysis has been superseded by later work.) Dennis Carlton and Jeffrey Perloff (p. 77) are among the textbook authors adopting a version of the Stigler definition.

Fixed costs – which are independent of output as long as the firm does not exit – are a source of economies of scale. But unless entry involves sunk costs – which cannot be recovered or, if amortized and treated as a flow, cannot be avoided if exit occurs – contestability theory teaches that scale economies do not suffice to permit established firms to hold price above cost without attracting (hit-and-run) entry. (See William J. Baumol, John C. Panzar, and Robert D. Willig. These are polar case concepts: in practice, costs are rarely completely fixed or sunk forever.) An updated Bain definition would not rule out scale economies as an antitrust barrier to entry when sunk costs are important, while the Stigler definition would. It is not clear how either author would interpret sunk costs that discourage entry even in the absence of significant scale economies, an issue addressed in Section IV below.

I. Entry Barriers in Antitrust Analysis

It is hard to argue that U.S. antitrust policies toward resale price maintenance, tying contracts, and price discrimination represent coherent pursuit of *any* economic goal. In the last few decades, however, legal scholars have increasingly argued that antitrust policy should aim to maximize “consumer welfare,” generally by opposing artificial restraints on competition, and this view has come to dominate decision-making by both enforcement agencies and courts in the core areas of antitrust. (For useful discussions, see Phillip Areeda and Louis Kaplow, pp. 12-51, Robert H. Bork, chs. 1-3, Herbert Hovenkamp, ch. 2, and Richard A. Posner, ch. 1.) “Consumer welfare” is generally interpreted as equivalent to consumers’ surplus:

The consumer welfare principle in use has become identical with the principle that the antitrust laws should strive for optimal allocative efficiency. Perhaps an only slightly cruder alternative is that antitrust policy under the consumer welfare principle chooses that option which leads to highest output and lowest prices in the market in question. (Herbert Hovenkamp, p. 76)

In contrast, economists usually employ total welfare – consumers’ surplus plus producers’ profits – as their partial equilibrium objective function. For instance, Oliver E. Williamson showed in a well-known 1968 article that a small merger-induced cost reduction can outweigh the negative effect on total welfare of a large increase in market power, but this insight has not shaped merger policy. Instead, the U.S. Department of Justice/Federal Trade Commission (DOJ/FTC) Horizontal Merger Guidelines (p. 31) explicitly adopt a consumer welfare standard for the analysis of cost reduction: the central question is posed as “...whether cognizable efficiencies likely would be sufficient to reverse the merger’s potential to harm consumers in the relevant market, e.g., by preventing price increases in that market.”

More broadly, as Phillip Areeda and Louis Kaplow (p. 35) summarize, “...the antitrust statutes mandate a policy in favor of competition.” (In a few exceptional cases courts have found that less competition benefits consumers. See, e.g., Richard A. Posner, pp. 29-32.) As the simple, illustrative models considered in the next two sections indicate, this is broadly consistent with a consumer welfare objective, but different, more complex, and thus less predictable policies would be in order if the objective of U.S. antitrust were total welfare.

In what follows I accept the objective of consumer welfare, because it is the goal that U.S. antitrust policy-makers have chosen. In light of this choice, it is hard to see how one could base a useful definition of antitrust barriers to entry on any other objective. (Thus I do not think

the interesting definitions of Franklin Fisher, Harold Demsetz, and C.C. von Weizsäcker (1980a, 1980b), which are based on total welfare considerations, are useful for U.S. antitrust.)

In antitrust cases involving price-fixing or other cartel behavior, conditions of entry play no role in the analysis. In most other settings entry conditions are considered in the analysis of market power. The DOJ/FTC *Antitrust Guidelines for Collaborations Among Competitors*, for instance, indicate that a finding of substantial entry barriers makes it more likely that a suspect practice will be challenged, because such a finding implies that new entrants are unlikely to be able to undo any anticompetitive (i.e., anti-consumer) effects of the practice. Similarly, in monopolization cases, a finding of entry barriers is generally necessary to establish that a high market share actually confers monopoly power. In the most highly developed area of U.S. antitrust, horizontal merger policy, the enforcement agencies ask whether entry would be “so easy that market participants could not profitably maintain a price increase above pre-merger levels” (DOJ/FTC *Horizontal Merger Guidelines*, p. 25).

In these and other settings, what matters is the ability of potential entrants to undo an actual or potential reduction in the intensity of competition. The key question is usually quantitative: to be useful in merger analysis, for instance, a measure of the height of antitrust entry barriers should be inversely related to the extent to which entry can be expected to thwart attempts by the merged firm to exercise market power. The Bain definition poses this question directly (though it does not tell one how to answer it), but the Stigler definition does not. It is thus not surprising that, as Herbert Hovenkamp (p. 40) notes, “antitrust analysis has mainly used the Bainian rather than the Stiglerian definition of entry barriers.”

Both these definitions are framed in long-run terms, as is the illustrative analysis below. Policy-makers, however, properly care how rapidly entry could enhance competition. (See,

importantly, the DOJ/FTC *Horizontal Merger Guidelines*, Section 3.) Dennis Carlton's discussion shows that the Stigler definition cannot easily be generalized to take dynamics into account. One way (not necessarily the best) to generalize the Bain definition is to imagine a hypothetical merger of all producers in a well-defined antitrust market (typically, the smallest product/geographic aggregate that could profitably be monopolized). Antitrust barriers to entry could then be defined as factors that elevate the post-merger price trajectory over time, either temporarily (by slowing entry) or permanently (per the original Bain definition.) Important as it is in many antitrust contexts to go beyond the Bain and Stigler definitions to take into account the dynamics of entry (as Dennis Carlton and Preston McAfee et al also argue), economists unfortunately seem to have produced very little potentially relevant theory and essentially no systematic empirical analysis of factors that slow entry.

II. Variable Cost Advantages

A very simple model without economies of scale or sunk costs illustrates the importance of the choice of antitrust policy objective. Suppose market demand is given by $Q = 1 - P$, fixed and sunk costs are zero, and unit variable costs are constant. A proposed merger would create a monopoly with unit variable cost $u_i < 1$. There are N potential entrants, each with unit variable cost $u_e < 1$, that will enter if they earn profits in the post-entry Cournot equilibrium. (See my 1976 note for a related analysis of the case $N = 1$.) Is there an antitrust barrier to entry here, and, if so, how high is it?

If $u_e \leq u_i$, there is clearly no barrier, and post-merger entry would increase both consumer welfare and total welfare. If $u_e > u_i$, both Bain and Stigler would find an entry barrier to be present (at least for some sources of the cost difference) and would agree that its height would be increasing in u_e for given u_i . If $u_e > (u_i + 1)/2$, entry is deterred for all N . For lower values of u_e ,

all potential entrants enter. In the limiting post-entry equilibrium as N increases, $P = u_e$, the incumbent produces $(u_e - u_i)$, and the entrants in aggregate produce $(1 + u_i - 2u_e)$. As u_e falls, given u_i , consumer welfare always rises. But rent-seeking entry leads to inefficient production here, and total welfare falls as u_e falls if $u_e > (2u_i + 1)/3$. Total welfare is higher after entry than under monopoly, even in the limit for large N , only if $u_e < (5u_i + 1)/6$.

The assertions that there is an antitrust barrier to entry if $u_e > u_i$ and that its height is increasing in u_e for given u_i are consistent with a consumer welfare objective. The higher is u_e , the less effective entry would be in forcing an incumbent monopolist to lower price. These assertions are inconsistent with a total welfare standard, however, since reductions in u_e over much of the relevant range actually reduce total post-entry welfare. If total welfare were the policy objective, neither the Bain nor the Stigler definition would be useful.

III. Sunk Costs and Economies of Scale

Suppose that market demand is again given by $Q = 1 - P$ and behavior is again Cournot. Variable cost is now zero, and entry requires incurring a fixed cost that is entirely sunk – i.e., it cannot be avoided at all by exit. Suppose a proposed merger would create a monopoly with total sunk cost F_i , and potential entrants would each need to incur a sunk cost of F_e , where $F_i, F_e < 1/4$. There are many potential entrants. For purposes of merger analysis, is there an antitrust entry barrier here and, if so, how important is it?

Stigler would only find an entry barrier if entrants would incur costs that the incumbent did not, so that $F_e > F_i$. Since post-entry equilibria generally have price above average cost for $F_e > 0$, Bain would generally find a barrier whenever $F_e > 0$. Stigler would presumably measure the height of the barrier, if any, by some increasing function of $(F_e - F_i)$. Bain would presumably use some increasing function of F_e , because it determines the post-entry price.

The key analytical point is that how much entry, if any, occurs in this model depends only on F_e , not on $(F_e - F_i)$. Similarly, since F_i is sunk, it is irrelevant to any analysis of the effects of merger or of entry. The post-entry Cournot equilibrium is profitable for N entrants if $F_e < F^*(N) \equiv 1/(N+2)^2$, regardless of the value of F_i . Thus a monopolist may be immune to entry even though Stigler would find no barrier, or it may be highly vulnerable to entry even though Stigler would find a significant barrier. Regardless of the objective of antitrust policy, the Stigler definition does not help describe the post-entry equilibrium in this model.

Now consider assessing the height of antitrust entry barriers. The smaller is F_e , the lower is the post-entry market price, and thus the higher is post-entry consumer welfare. Accordingly, F_e is a sensible measure of the height of antitrust entry barriers if the policy objective is consumer welfare. But it would not be appropriate if the objective were total welfare. As C.C. von Weizsäcker (1980a, b) may have been the first to note, rent-seeking leads to excess entry in this sort of model. (See Gregory N. Mankiw and Michael D. Whinston for a more general analysis.) Reducing F_e from just above any $F^*(N)$, for $N \geq 1$, to just below such a critical value increases by one the number of entrants in the post-entry equilibrium, drives price down to average cost, and causes a discrete drop in post-entry welfare. For $N \leq 4$, total welfare just below $F^*(N)$ is below the monopoly level.

In this simple model, given a consumer welfare objective and given the role entry conditions play in U.S. merger policy, the natural measure of antitrust entry barriers is F_e , which captures the importance of potential entrants' scale economies relative to the market. The Stigler definition has no useful role to play in analysis of the ability of entry to force post-merger price reductions. All this is broadly consistent with the Bain definition, with the way scale economies are considered in the DOJ/FTC *Horizontal Merger Guidelines* and *Antitrust Guidelines for*

Collaborations Among Competitors, and with the U.S. antitrust mainstream. *Scale economies associated with sunk costs can deter new competition that would raise consumers' surplus and are thus a potential source of antitrust barriers to entry.*

What matters in this analysis is what would be required for an entrant to compete effectively, not the scale or absolute efficiency of incumbent firms. A classic example of focusing on the latter rather than the former is Judge Learned Hand's labeling of Alcoa's "new capacity already geared into a great organization, having the advantage of experience, trade connections, and the elite of personnel" as exclusionary (*U.S. v. Aluminum Company of America*, 148 F. 2d 416, 431 (2d Cir. 1945)). See also the trial court's discussion of the "applications barrier to entry" in *Microsoft* (84 F. Supp. 2d 9 (D.D.C. 1999)).

IV. Sunk Costs Alone

Many discussions of sunk costs (e.g., Dennis Carlton and Jeffrey Perloff, pp. 79-80, and Herbert Hovenkamp, pp. 528-9) note that their presence may deter entry by making it riskier. This mechanism does not require economies of scale. A very simple example shows, however, that without scale economies, even though sunk costs may deter entry, they do not thereby give rise to an antitrust entry barrier. (See Avinash Dixit and Robert Pindyck, chs. 8-9, for a more elaborate dynamic model with demand uncertainty that has similar implications.)

Suppose many potential entrants each have one unit of capacity and are small enough relative to the market to be rational price-takers. Each potential entrant, in sequence, first observes market price, P , and then decides whether to enter by investing a (small) sum, F . If it enters, the firm first observes its unit variable cost, u , a draw from a smooth cumulative distribution function, $G(u)$, defined on $[\underline{u}, \bar{u}]$ and then decides whether to exit and earn profit $\pi = -\sigma F$ or to produce one (small) unit of output and earn $\pi = P - u - F$. Thus in this static model F is

each firm's fixed cost, of which a fraction σ is sunk. An entrant will decide to operate if its unit variable cost is less than or equal to $P - (1 - \sigma)F \equiv u^*$. Sequential entry will drive price down, and entry will stop when $E[\pi(P, \sigma)] = G(u^*)[u^* - E(u \mid u \leq u^*)] - \sigma F \leq 0$. Expected profit is increasing in P , so $E[\pi(P^*, \sigma)] = 0$ defines P^* as the equilibrium price.

Consider first the extreme case $\sigma = 0$. Then $E(\pi) > 0$ whenever $u^* > \underline{u}$, i.e., whenever $P > \underline{u} + F$. Thus $P^* = \underline{u} + F$ when there are no sunk costs; price is driven to the lowest possible level of total unit cost. For $\sigma > 0$, implicit differentiation of $E[\pi(P^*, \sigma)] = 0$ establishes $dP^*/d\sigma > 0$ for $u^* < \bar{u}$. The larger the fraction of fixed cost that is sunk in this range, the higher is the equilibrium price. When sunk cost, σF , is large, entrants choose to operate regardless of their variable cost draw, and further increases in σ have no effect on P^* . For example, if u is uniformly distributed, P^* increases with σ for $\sigma F < (\bar{u} - \underline{u})/2$, and it equals $[(\bar{u} + \underline{u})/2 + F]$ for all larger values of σF .

The more important is sunk cost in this model, the less attractive is entry, and the higher is the equilibrium price. In some policy contexts it may make sense to say that sunk cost creates a barrier to entry here, but there is no *antitrust* barrier to entry in this static model. (If sunk costs delayed entry in a dynamic model, this would not be true.) To see this, suppose price is above P^* and all incumbent firms merge. Price-taking entry will then drive price to or below P^* , just as if the merger had not occurred. In this model, P^* plays the role of Bain's "minimal average cost." This simple example shows that *even if scale economies are unimportant, sunk costs may discourage entry by lowering expected profits, but if competition is not thereby limited, no antitrust barrier to entry is created.*

REFERENCES

- Areeda, Phillip and Kaplow, Louis.** *Antitrust Analysis*, 5th Ed. Boston: Little, Brown, 1997.
- Bain, Joe S.** *Barriers to New Competition*. Cambridge: Harvard University Press, 1956.
- _____. *Industrial Organization*, 2nd Ed. New York, John Wiley, 1968.
- Baumol, William J., Panzar, John C. and Willig, Robert D.** *Contestable Markets and the Theory of Industry Structure*. New York: Harcourt Brace Jovanovich, 1982.
- Bork, Robert H.** *The Antitrust Paradox*. New York: Basic Books, 1978.
- Carlton, Dennis W.** “Why Barriers to Entry are Barriers to Understanding.” *American Economic Review Papers and Proceedings*, May 2004, 94, (this session).
- _____. and **Perloff, Jeffrey M.** *Modern Industrial Organization*, 3rd Ed. Reading, MA: Addison-Wesley, 2000.
- Fisher, Franklin M.** “Diagnosing Monopoly.” *Quarterly Review of Economics and Business*, Summer 1979, 19, pp. 7-33.
- Demsetz, Harold.** “Barriers to Entry.” *American Economic Review*, March 1982, 72(1), pp. 47-57.
- Dixit, Avinash K. and Pindyck, Robert S.** *Investment Under Uncertainty*. Princeton: Princeton University Press, 1994.
- Hovenkamp, Herbert.** *Federal Antitrust Policy*, 2nd Ed. St. Paul, Minn.: West, 1999.
- McAfee, R. Preston, Mialon, Hugo M., and Williams, Michael A.** “What is a Barrier to Entry?” *American Economic Review Papers and Proceedings*, May 2004, 94, (this session).
- Mankiw, N. Gregory and Whinston, Michael D.** “Free Entry and Social Inefficiency.” *Rand Journal of Economics*, Spring 1986, 17(1), pp. 48-58.

- Posner, Richard A.** *Antitrust Law*, 2nd Ed. Chicago: University of Chicago Press, 2001.
- Schmalensee, Richard.** "Is More Competition Necessarily Good?" *Industrial Organization Review*, 1976, 4, pp. 120-121.
- Stigler, George J.** "Barriers to Entry, Economies of Scale, and Firm Size," in George J. Stigler, *The Organization of Industry*. Homewood, IL: Irwin, 1968.
- Tirole, Jean.** *The Theory of Industrial Organization*. Cambridge, MA: MIT, 1988.
- U.S. Department of Justice and Federal Trade Commission.** *Horizontal Merger Guidelines*. Washington, DC: Revised April 1997.
- _____. *Antitrust Guidelines for Collaborations Among Competitors*. Washington, DC: April 2000.
- Von Weizsäcker, C.C.** "A Welfare Analysis of Barriers to Entry." *Bell Journal of Economics*, Autumn 1980a, 11(2), pp. 399-420.
- _____. *Barriers to Entry: A Theoretical Treatment*. New York: Springer-Verlag, 1980b.
- Williamson, Oliver E.** "Economies as an Antitrust Defense: The Welfare Tradeoffs." *American Economic Review*, March 1968, 58(1), pp. 18-36.

HEADNOTE

* MIT Sloan School of Management, Cambridge, MA 02142 (rschmal@mit.edu). I am indebted (with the usual disclaimer) to David Evans, Paul Joskow, Robert Pindyck, Jean Tirole, and the other session participants for exceptionally useful comments.